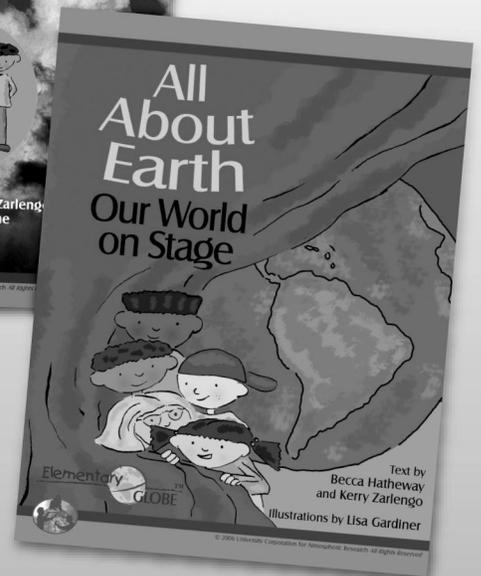
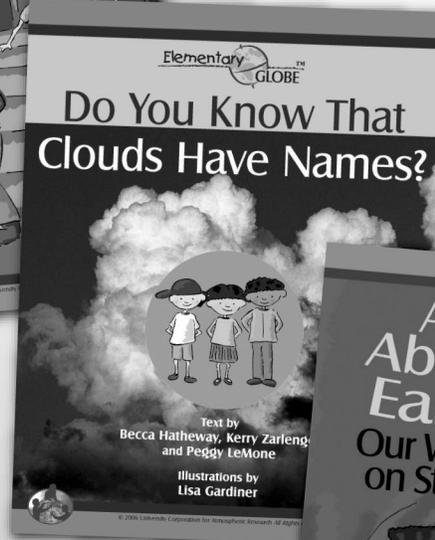
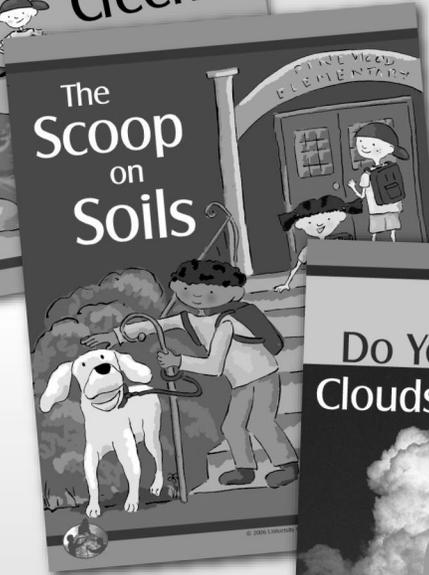
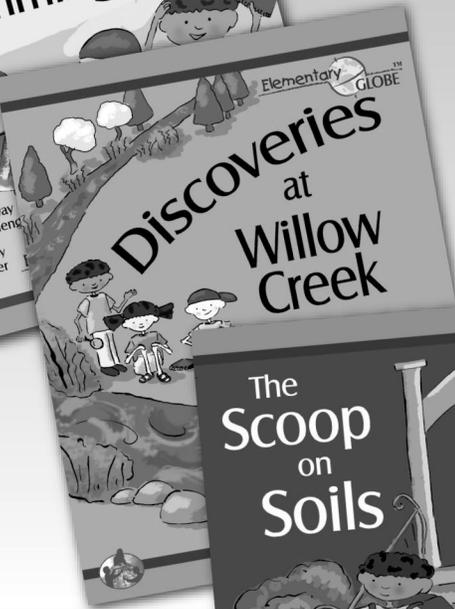
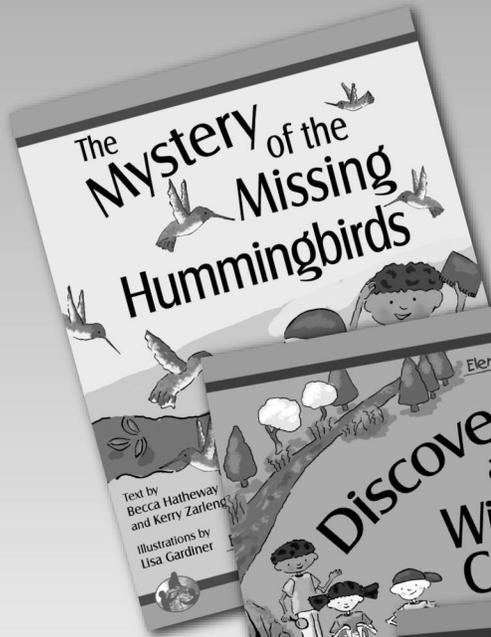




Teacher's Implementation Guide



Text by Becca Hatheway, Susan Gallagher and Sandra Henderson
Illustrations by Lisa Gardiner



About Elementary GLOBE

Recognizing the current emphasis on basic literacy skills in elementary classrooms and the challenge many elementary school teachers face to include science in their daily instruction, we developed *Elementary GLOBE*. We wanted to help K-4 teachers integrate Earth science into their curriculum as they teach students to read and write.

Elementary GLOBE is an instructional unit comprising five modules. Each module contains a science-based storybook and learning activities that support the science content covered in the storybooks. The five science content topics cover seasons, water, soil, clouds, and Earth as a system.

Storybooks:

Each storybook features the “GLOBE Kids” as they explore and investigate the natural world as seen through the eyes of young learners. Simon, Dennis, and Anita are the main characters in each of the storybooks and provide a consistent element that young students can relate to in the *Elementary GLOBE* series.

The settings for the stories are based on North American ecosystems. They are not set in specific locations except for the Seasons module. In *The Mystery of the Missing Hummingbirds* storybook, the setting is in Pennsylvania which provides an accurate location for the ruby-throated hummingbird habitat.

Learning Activities:

Each storybook has three learning activities that further explore the science content or provide instruction in basic science process skills. The materials necessary to implement the learning activities in a classroom are inexpensive and easy to find. All of the learning activities have been field tested in classrooms around the United States.

Teacher's Notes and Glossary:

Teacher's Notes and a Glossary are included in the back of each storybook. The Teacher's Notes provide basic science background information. Teachers are strongly encouraged to read the Teacher's Notes prior to using the materials in their classroom. The Glossary information is designed to help teachers explain terms in the story narratives to their students. Each learning activity also contains Teacher's Notes that teachers should read before sharing the activity with students.

About the Teacher's Implementation Guide

The *Elementary GLOBE* Teacher's Implementation Guide is written for you – the K-4 classroom teacher. The Teacher's Implementation Guide includes an overview of the resources and background necessary to implement *Elementary GLOBE* in K-4 classrooms. It is recognized that cognitive development as well as ability and skills of students in the K-4 age range vary widely. Kindergarten teachers will use *Elementary GLOBE* very differently than will those teaching grades 3 or 4. Information is included, where possible, at different grade levels. When we developed *Elementary GLOBE* for grades ranging from kindergarten to fourth grade, we knew it would be necessary to consider a variety of ways to implement *Elementary GLOBE* in the classroom. The storybooks and learning activities were field tested and reviewed by teachers covering the K-4 grade span. Much of the information in the Teacher's Implementation Guide is based on feedback and input from these teachers.

The Teacher's Implementation Guide includes brief overviews/discussion of:

- Connections to Literacy
- Science Inquiry in the Elementary School Classroom
- Classroom Implementation Suggestions
- Appendices
 - Appendix 1: Alignment with Educational Standards
 - Appendix 2: An Overview of *Elementary GLOBE* Materials
 - Appendix 3: Additional Resources
 - Appendix 4: Inquiry Process Skills Checklist

Getting Started

Before reading the Teacher's Implementation Guide, it is recommended that you familiarize yourself with the storybooks and learning activities. If you are not familiar with the *Elementary GLOBE* storybooks, you may want to look at Appendix 2: An Overview of *Elementary GLOBE* Materials before you read the Teacher's Implementation Guide which provides an overview of the content included in the series.



Elementary GLOBE: Correlations to Education Standards

The *Elementary GLOBE* materials have been correlated to National Science Education Standards, National Geography Standards, and the Principles and Standards for School Mathematics. Appendix 1 lists these correlations. Note that Appendix 1 lists only the standards that are covered in *Elementary GLOBE*. Depending on your district or state requirements, you may want to correlate the *Elementary GLOBE* materials to your own grade-level standards, including science, math, geography, and literacy.

Connections to Literacy

We are defining literacy as the ability to read and write at a specified age. In addition to literacy skills (reading and writing), *Elementary GLOBE* contributes to science literacy skills (content knowledge and inquiry process skills) as well. The storybooks and learning activities are designed to be used as interdisciplinary materials where students read, write, and comprehend science information.

As a K-4 classroom teacher, you are already well versed and skilled in teaching language arts. We provide some brief discussions on practices that may make it easier to implement *Elementary GLOBE* while recognizing our discussion is primarily to get you started thinking. Our discussion is not meant to be exhaustive. Your own expertise in the area of language arts will be very important in the implementation of *Elementary GLOBE*.

Science and Literacy

At first glance, it might not seem that science and literacy are a likely match. However, on closer examination, they make very good partners in K-4 classrooms. We know that students are better able to develop reading, writing, and communication skills when the content is meaningful and stimulating to them. Science can strengthen literacy skills by providing meaning and context. For example, in *The Mystery of the Missing Hummingbirds*, the GLOBE Kids conduct research in the library and on-line and write emails to relatives to learn more about the hummingbirds. The students need to

read, write, and communicate in order to further their understanding of science. Literacy skills strengthen science learning by providing students the means to focus and clarify their ideas, conclusions, inferences, and procedures. In *All About Earth: Our World on Stage*, the GLOBE Kids communicate with each other to clarify their understandings of the connections between the different parts of the Earth system. In addition, they perform a play in order to communicate this information to the rest of their school.

The *Elementary GLOBE* storybooks were not intended to be science textbooks. They were developed to provide an engaging story featuring three early elementary age kids who typically investigate some aspect of their environment. The GLOBE Kids (Simon, Dennis, and Anita) pose questions, make observations, collect data, and come to conclusions. They read, write, and orally communicate during the course of their investigations. In short, while enhancing their literacy skills, your students will explore the natural world with Simon, Dennis, and Anita.

There have been many studies recently that explore the effectiveness of linking science learning and literacy skills. One recent study compared the characteristics of an inquiry-based science program with the list of literacy skills a student should have and showed the lists are remarkably similar (Their, 2002). Both lists describe behaviors and skills that we want students to develop in the areas of science and language arts. Both lists note that students should have the ability to:

- note details
- compare and contrast
- predict
- sequence events
- link cause and effect
- distinguish fact from opinions
- link words with precise meanings
- make inferences
- draw conclusions

We believe that *Elementary GLOBE* can help develop these behaviors and skills in elementary grade students. *Elementary GLOBE* connects science content with language arts and can provide the opportunity for these students to further their literacy skills while learning ideas about science.



Literacy skills are a significant component of K-4 instruction and learning. *Elementary GLOBE* was developed to provide a meaningful and stimulating context as students learn how to effectively read and write. *Elementary GLOBE* materials can best be used in the areas of vocabulary development, reading comprehension, and journaling.



Vocabulary Development

The *Elementary GLOBE* storybooks and learning activities can help your students increase all four types of their vocabulary – reading, listening, speaking, and writing. For the lower grades, their reading vocabulary would not be at the level necessary for them to read *Elementary GLOBE* on their own. It would be more appropriate for you to read the books to your students, taking the time to discuss the new vocabulary words in a context that makes them understandable. At the urging of our field testers, certain higher level vocabulary words were included to stretch the vocabulary provided. For example, in *The Scoop on Soils* storybook, we included words such as “soil profile,” “silty,” “texture,” and “structure.” These words might not be familiar to many elementary students; however, learning the meaning of such words will enrich their science understanding.

You might find some of the following strategies useful in developing your students’ vocabulary.

- **Word Wall:** Before reading the *Elementary GLOBE* storybooks or working through one of the learning activities with your students, list key vocabulary words on the board or on a piece of chart paper. Introduce these words to your students before you read the storybooks or work on the learning activities. As you read the storybooks or learning activities, continue to add to the word wall as you and your students encounter new and relevant

vocabulary words. Encourage your students to refer to the word wall when they read the storybooks, write in their journals, or record information on the Student Activity Sheets.

- **Picture Walk:** The illustrations in the *Elementary GLOBE* storybooks were meant to engage young learners. In many instances, the illustrations provide information to enhance and enrich the science content of the storybooks and also to introduce new words. For example, on page 19 of the *Discoveries at Willow Creek* storybook, Simon’s journal includes a water strider, a whirligig beetle, and a water boatman. On page 2 of *The Scoop on Soils* storybook, the GLOBE Kids’ journals provide useful information on “soil profiles” and also includes centimeters and inches as ways to record measurement. When reading the storybooks, pause periodically and ask your students to discuss what is going on in the storybook illustration. Ask your students to use vocabulary words from the word wall to describe what they see in the storybook illustrations.

Reading Comprehension

Elementary GLOBE can help your students improve their reading comprehension. You can use the storybooks to provide opportunities for improvement in understanding, remembering, and communicating to others the content of the storybooks. The illustrations in *Elementary GLOBE* were meant to help students visualize the new information being presented in the storybooks.

Students will be able to make several different kinds of connections after reading the storybooks including:

- **Text to Self Connection:** This occurs when readers link the text to their past experience or background knowledge. For example, when reading the *Discoveries at Willow Creek* storybook, students might recall experiences they have had at streams or rivers.
- **Text to Text Connection:** This occurs when readers recognize connections from one book to another. If you have read more than one of the storybooks, your students might be able to identify an action or event from a previous *Elementary GLOBE* storybook that relates to the current book. In addition, your



students can make a connection between one of the storybooks and another book about the same subject. Ask your students specific questions that will help them make these connections.

- **Text to World Connection:** This occurs when readers connect the text to events or issues in the real world. Because the *Elementary GLOBE* storybooks are based on realistic science content, you should be able to make connections from the storybooks to your local environment (e.g., animal migration, seasonal changes, clouds, etc.).

The “Five Finger Retell for Comprehension” strategy is effective in helping students organize their thoughts regarding comprehension.

Thumb – Who were the main **characters**?

Forefinger – Where did the story take **place**?

Middle finger – What was the series of **events** in this story?

Ring finger – What was the **problem**?

Pinky finger – What was the **solution**?

You might want to expand the Five Finger Retell to include the palm and back of the hand to incorporate additional information.

Palm of hand – What was the **main idea** of the story?

Back of hand – What **connections** can you make between this story and something in your life?



Journaling

The GLOBE Kids make frequent use of their science journals. They write and draw in their journals as they investigate the world around them. In *The Mystery of the Missing Hummingbirds*, the students use their journals to record observations in their school garden. Simon, Dennis, and Anita record information about the soil profiles they find in *The Scoop on Soils*. And in *Discoveries at Willow Creek*, the GLOBE Kids compare information in their journals from visits during two different seasons to the creek to learn how that environment has changed.

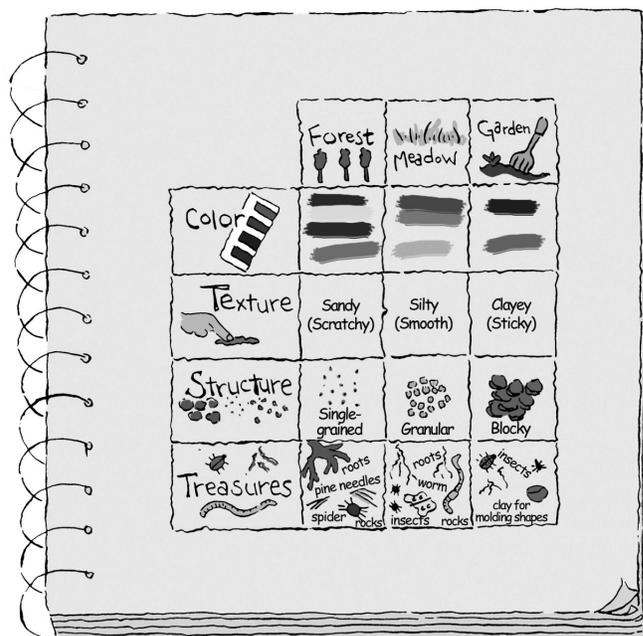


Figure 1. Example of a science journal page from *The Scoop on Soils*.

Keeping a science journal provides a place for students to record information and helps them focus their observations. Student journals allow for literacy connections in your science curriculum by encouraging students to write and communicate their thoughts.

The *Elementary GLOBE* Student Activity Sheets found in the learning activities can be used individually or made into a notebook or journal. These notebooks can also include blank pages where students have space for recording information in freeform style. You can also use composition books as journals and insert the Student Activity Sheets into the composition book once they are complete.



Name Juliana
 Date 11-1-05
 Weather sunny, chilly, and breezy
 Clothing long sleeve shirt, pants, and a hat

Big Picture View
 Write or draw your observations here.

Trees were everywhere, some trees had only a few leaves.
 I saw tall grass growing by the trees.
 A lot of trees were very tall.

Figure 2. Example of a completed Student Activity Sheet of student observations.

Science Inquiry in the Elementary School Classroom

Scientific inquiry in the K-4 classroom extends beyond using only traditional process skills to incorporating scientific knowledge by using scientific reasoning and critical thinking to develop their understanding of science (National Research Council, 2000). The Five Essential Features of Inquiry listed in Figure 1 provide an outline for moving through all stages of scientific reasoning, critical thinking, and evaluation of explanations.

Listed in Figure 4 are some examples of the Five Essential Features of Inquiry that can be found in the *Elementary GLOBE* storybook narratives.

The *Elementary GLOBE* storybooks and learning activities provide students with opportunities to engage in scientific inquiry activities at appropriate levels. The storybooks provide narrative examples as models of how students might engage in each of the five essential features of scientific inquiry. As you recognize the scientific inquiry skills in the storybook or learning activities narratives, make the connection for your students between that specific skill and a recent classroom or local environmental example with which they are familiar. This will help reinforce each step as a part of scientific inquiry. Students will become aware that they often use the same skills as the GLOBE Kids use in the story narratives.

Elementary students will be more successful with this type of discovery if they learn the skills initially before experiencing the process as a whole. Not all inquiry skills need to be included in each learning activity. The skills can be broken down and taught as one step that students then combine to complete all the steps of scientific inquiry. Modeling or practicing these skills will improve the students' ability to successfully use each of these skills in a series of steps later on. For example, students may not know how to make good observations without modeling or coaching. Practice making good observations together before sending them outside to complete an activity.

1. Questions	2. Evidence	3. Explanations	4. Connect	5. Communicate
Learner engages in scientifically oriented questions	Learner gives priority to evidence in responding to questions	Learner formulates explanations from evidence	Learner connects explanations to scientific knowledge	Learner communicates and justifies their explanations

Figure 3. Essential Features of Classroom Inquiry (Taken from the National Research Council's *Inquiry and the National Science Education Standards*).

1. Questions	2. Evidence	3. Explanations	4. Connect	5. Communicate
The GLOBE Kids ask, "Where did the hummingbirds go?" after observing the birds' disappearance in their garden.	Simon makes a chart to record their observations of the soil from the three different holes that Scoop had dug.	The GLOBE Kids look at their wall charts of observations and explain that the hummingbirds could stay there only when they had enough food and shelter.	Scientist Hannah helps the GLOBE Kids connect their observations to the snowmelt feeding the creek.	The GLOBE Kids each justify why their part of the Earth system is most important, and then how each is connected in the Earth system, during the classroom play.

Figure 4. Examples of the Five Essential Features of Inquiry from the *Elementary GLOBE* storybook narratives.



Inquiry Process Skills

The following is a list of skills that you may want to practice with your students to build their inquiry process skill set prior to conducting an entire scientific inquiry activity.

Observing

Looking/watching things with a purpose

Questioning

Formulating questions based on observations

Sequencing

Putting something in a certain order

Patterning

Forming and following a set pattern

Counting

Understanding quantity, one-to-one correspondence

Measuring

Using standard and nonstandard units

Comparing

Noting differences and similarities of things

Classifying

Putting things into definite categories

Defining

Developing and enhancing vocabulary

Communicating

Describing and sharing information with others

Hypothesizing

Making an informed guess

Predicting

Thinking ahead about what might happen

Inferring

Using reasoning to draw conclusions

Recording

Writing or drawing gathered information

Reporting

Using information and communicating it to others

(Owens, 1999)

This list may also be used to evaluate or track the skills that you are teaching in each learning activity. A model checklist that you can photocopy and use is provided as Appendix 4.

Classroom Implementation

Implementing *Elementary GLOBE* into your classroom is relatively easy as it is a very flexible series of materials. You may choose to integrate only one storybook into your existing required curriculum where appropriate or you may wish to integrate the entire series throughout an entire school year. Each storybook and set of learning activities can stand alone. You may want to work with other K-4 teachers in your building or district to determine where the materials are best aligned in your curriculum.

In determining the best fit for each storybook content area, keep in mind that some of the learning activities can be revisited during the school year as your students will be exploring changes over time. You may find it interesting to save your students' Student Activity Sheets and journals, then repeat the activity, and return the original work to have students compare and contrast the changes they find. You may also match other activities with the *Elementary GLOBE* storybooks such as Project WILD Aquatic activities with *Discoveries at Willow Creek*. You might also build a comparison over time by saving students' work from a prior year(s) and let current students compare their work to former students' observations.

The *Elementary GLOBE* storybooks work very well as a guided read aloud. Reading sessions can be broken up, depending on how much discussion you want to have with students as you are reading. In addition, you might want to refer back to the storybooks after completing some of the learning activities to make connections between what the GLOBE Kids did in the story and what your students are experiencing. The GLOBE Kids in the storybooks often model what your students are doing in the learning activities, so it is useful to make this connection with your students. Depending on reading ability, older students might want to read the storybooks alone or in pairs.

The learning activities can be used in a variety of ways to support student learning and skill acquisition. The supporting learning activities were designed to be used after reading the book. However, three of the modules have learning activities that would be good introductory activities for the unit. *All Year Long*, *Magnify That*, and *Getting to Know Soil* are labeled as an "Introductory Activity" in the Learning Activities at



a Glance (Table 2, pp 8-10). Suggestions for time and management are also included in this table. You may also want to consider your particular climate in deciding the timing of outside activities. Also, adjustments or modifications for urban schools might involve setting up mock environments at stations for students to explore or make observations if going outside to a natural environment is not possible.

You may even want to brainstorm ideas with your colleagues about how best to arrange stations, student teams or groups, and assessment ideas for each module. Rubrics can be used to identify specific skills or outcomes that the students should be able to do at the end of each learning activity. Collaborative learning skills can be applied to many of the learning activities and included in rubrics to help guide the students' time on task during the class.



Inquiry Activities by Grade Level

Table 1 contains information that can help teachers from different grade levels in the K-4 range decide which inquiry activities to focus on while using the *Elementary GLOBE* materials.

Grade Level	Kindergarten	Grades 1, 2	Grades 3, 4
Inquiry Activities by Grade Level	<ul style="list-style-type: none"> • Students raise questions about the world around them and gather evidence through careful observations. • Students draw pictures and use language to describe their findings. • Students compare results in terms of number, shapes, textures, size, weight, and color. • Students share findings with others. Students work in a team to do science. 	<ul style="list-style-type: none"> • Students work in a team to do science yet understand the importance of reaching their own conclusions and individually understanding the results. • Students raise questions about the world around them and gather careful observations to answer these questions to formulate explanations. • In addition to observations, students can design investigations to answer their questions about the world. • Students communicate their explanations to others. 	<ul style="list-style-type: none"> • Students raise questions about the world around them, gather evidence through many types of investigations including careful observations and doing experiments. • Consistently following a procedure and keeping careful records are important to create explanations based on evidence that are understandable to all in the future. • Students connect their explanations to existing scientific knowledge. • Students communicate their explanations to others.

Table 1. Inquiry activities by grade level from Inquiry and the National Science Education Standards (NRC, 2000).



Learning Activities at a Glance

Table 2 covers the learning objectives, what students do, what inquiry skills are used, the materials needed, and the amount of time needed. Each learning activity also includes “Teacher’s Notes” with background content information for teachers, and “Student Activity Pages” that have space for students to record observations and other information. Some of the learning activities work best when students are working alone or in small groups, and other learning activities work best with the whole class. Each learning activity has a section called “Adaptations for Younger and Older Students” that provides additional information, tips, or extensions to use with students on the younger or older end of the K-4 range.

Title	Learning Objective	What Students Do	Inquiry Skills	Materials
SEASONS MODULE				
All Year Long (Introductory Activity) Time: Part 1: 30-45 mins. Part 2: 15 minutes Part 3: 60 mins. per month/season Part 4: 30 minutes	Students will be able to describe the seasonal changes in a local habitat by making detailed observations, recording their results, making comparisons, and sharing information with others.	Students keep a science journal during each of four seasons. They will record observations of the general outdoor environment and one specific item from the habitat in each season. They will make comparisons of their observations from each season.	Observing Measuring Comparing Classifying Defining Communicating Recording	Overhead transparencies, large pictures of flowers and landscapes, plastic bags, colored pencils, pencils, rulers, magnifying lenses, Student Activity Sheets
Colors of the Seasons Time: Part 1: 30 minutes Part 2: 60 mins. per month/season Part 3: 30-45 mins.	Students will be able to explain how colors in nature relate to their local environment and to seasonal changes within that environment.	Students make observations outside during each season, recording as many colors as they can find. At the end of the school year they compare results and generate conclusions about variations in color within and between seasons.	Observing Counting Comparing Classifying Defining Hypothesizing Recording Reporting	Color samples (construction paper or paint chips), fasteners, hole punch, markers, clipboards, pencils, chart paper, Student Activity Sheet
Honing in on Hummingbirds Time: Part 1: 30-45 mins. Part 2: 30 minutes Part 3: 30-60 mins.	Students will be able to conduct a research project related to ruby-throated hummingbirds and will be able to communicate their results using different formats.	Students will make lists of what they already know and what they want to learn about ruby-throated hummingbirds. After doing some research they will make 3-D hummingbirds and play charades using them as props.	Observing Questioning Patterning Comparing Classifying Defining Communicating Reporting	Chart paper, markers, hummingbird information, basic art supplies, rulers, scale, Student Activity Sheet
WATER MODULE				
Magnify That (Introductory Activity) Time: Part 1: 30-45 mins. Part 2: 30-45 mins.	Students will be able to identify a magnifying lens and explain its purpose. They will be able to explain why an object looks different.	Students examine different objects, first without a magnifying lens and then with a magnifying lens, and compare what they see. They will practice observing details with a magnifying lens.	Observing Comparing Defining Communicating Recording Reporting	Magnifying lenses, paper, scissors, objects to observe, salt, sugar, white chalk, black paper, Student Activity Sheets

Table 2. Elementary GLOBE Learning Activities at a Glance.



Title	Learning Objective	What Students Do	Inquiry Skills	Materials
WATER MODULE (continued)				
Measure Up Time: Part 1: 30-45 mins. Part 2: 30-45 mins.	Students will be able to make nonstandard and standard linear measurements.	Students use various classroom objects to experiment with nonstandard measurement. Then they use a ruler or measuring tape to become familiar with these tools for standard linear measurement.	Observing Counting Measuring Comparing Defining Communicating Predicting Recording	Items to measure, rulers, plant seeds, soil, containers, Student Activity Sheets
Water Wonders Time: Part 1: 30-45 mins. Part 2: 30-45 mins. (several times for 2 weeks)	Students will be able to describe adaptive features of aquatic macroinvertebrates and their importance in the scientific study of water bodies.	After learning about different species of macroinvertebrates, students hypothesize why they look the way they do. Then they make observations of them in an aquarium (or at a stream or pond).	Observing Questioning Measuring Comparing Classifying Communicating Hypothesizing Recording	Copies of field cards, aquarium, sand, water, aquatic plants, aquatic insects, Student Activity Sheets
SOIL MODULE				
Getting to Know Soil (Introductory Activity) Time: Part 1: 30 minutes Part 2: 30 minutes	Students will be able to describe a soil profile and will be able to explain the different properties of soil, including texture, color, and size.	Students observe several different soil types and record their observations. Then they will learn about soil profiles by experimenting with soil and water in a clear jar and by making a soil profile flip book.	Observing Questioning Comparing Classifying Defining Recording Reporting	Soil samples, strainers, tweezers, toothpicks, magnifying lenses, rulers, water, markers, glass jar with lid, stapler, scissors, pencils, Student Activity Sheets
Soil Treasure Hunt Time: Part 1: 30 minutes Part 2: 30-45 mins.	Students will be able to list things found in soil such as rocks, roots, critters, and organic materials.	Students investigate a soil sample collected outside, sorting out the various items they find. Then they will make observations of soil at a few locations outside and write a story about the objects they found.	Observing Questioning Patterning Comparing Classifying Defining Recording	Soil samples, strainers, tweezers, toothpicks, eye droppers, magnifying lenses, rulers, pencils, markers, shovels, Student Activity Sheets
We All Need Soil! Time: Part 1: 30 minutes Part 2: 30 minutes Part 3: 45-60 mins.	Students will be able to explain soil's function for plants and animals and the overall importance of soil science.	Students make lists of what soil is made of and what lives in the soil. Then they will learn how much soil there is on Earth for plants and animals to use. Last, they will play an interactions game to learn why different plants and animals need soil.	Sequencing Classifying Defining Communicating Recording Reporting	Chart paper, markers, apple, small knife, copies of activity cards, Student Activity Sheet

Table 2. Elementary GLOBE Learning Activities at a Glance (continued).



Title	Learning Objective	What Students Do	Inquiry Skills	Materials
C L O U D M O D U L E				
Cloud Fun (Introductory Activity) Time: 30-45 minutes	Students will be able to describe the shape and appearance of cumulous clouds. They will be able to explain what kind of weather is to be expected when cumulous clouds are present.	Students observe the weather and cumulus clouds, then make a paper version of the cloud they observed using adjectives to describe the cloud.	Observing Classifying Defining Communicating Recording	Cloud chart, chart paper, white paper, blue paper, glue, pencils, Student Activity Sheet
Cloudscape Time: 60 minutes	Students will be able to identify cloud types using cloud classification names.	Students construct a sky scene including all of the cloud types. They describe each cloud type using their own vocabulary and then correlate this with standard cloud classifications.	Observing Measuring Classifying Defining Communicating Recording	Cloud chart, blue poster board, cotton balls, pillow batting, white fabric, markers, glue, scissors, rulers, Student Activity Sheet
To Spread or Not To Spread Time: Part 1: 30 minutes Part 2: 30 minutes	Students will be able to identify the three types of contrails.	Students use paint and water to explore the differences between the three types of contrails. Then they make observations of contrails outside at varying time intervals.	Observing Comparing Classifying Defining Communicating	White tempera paint, cups, paintbrushes, water, glue, straws, blue paper, airplane cut-outs, poster board, Student Activity Sheet
E A R T H M O D U L E				
Earth System in a Bottle Time: Part 1: 30-45 mins. Part 2: 30 minutes Part 3: 15-20 mins. (3 times for a week) Part 4: 45 minutes	Students will be able to conduct an experiment designed to test a plant's need for water, sunlight, and soil.	Students make terrariums in order to record the growth of radish plants. Some of the terrariums will have experimental conditions (no water, no soil, or no light). They will observe the terrariums over time and record what they see.	Observing Questioning Measuring Comparing Communicating Hypothesizing Recording	Chart paper, markers, clear plastic soda bottles, potting soil, radish seeds, index cards, foil, paper towels, water, Student Activity Sheet
We're All Connected Time: Part 1: 30-45 mins. Part 2: 30-45 mins. Part 3: 30-45 mins.	Students will be able to explain how the Earth's processes and components are interconnected.	Students make observations outside of interactions between components of the earth's system. After recording their observations, students share what they saw with the class.	Observing Comparing Defining Hypothesizing Communicating Reporting	Overhead transparencies, markers, pencils, colored pencils, Student Activity Sheet
Earth System Play Time: Part 1: 30-45 mins. Part 2: 30 minutes Part 3: 30 minutes	Students will be able to demonstrate their knowledge of how water, air, soil, and living things interact in the Earth system.	Students brainstorm, write, create, and produce a play in which they represent how all the parts of the Earth's systems are interconnected.	Comparing Classifying Communicating Recording Reporting	Chart paper, markers, miscellaneous materials for creating costumes, props, and backdrop

Table 2. Elementary GLOBE Learning Activities at a Glance (continued).



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The Teacher's Implementation Guide Credits

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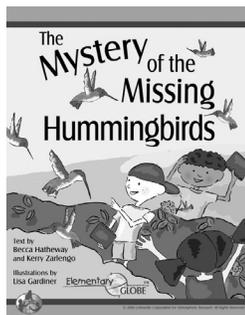


Alignment with Educational Standards

	CLOUDS		SOIL		SEASONS		WATER		EARTH						
	Cloud Fun	Cloudscape	To Spread or Not...	Getting to Know Soil	Soil Treasure Hunt	We All Need Soil	All Year Long	Colors of the Seasons	Honing in on Humm.	Magnify That	Measure Up	Water Wonders	Earth Sys. in a Bottle	We're All Connected	Earth System Play
Science Content Standard A: Science as Inquiry															
Abilities necessary to do scientific inquiry	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Science Content Standard B: Physical Science															
Properties of objects and materials			✓	✓	✓	✓	✓	✓	✓	✓					
Position and motion of objects					✓										
Science Content Standard C: Life Science															
The characteristics of organisms				✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Life cycles of organisms								✓			✓	✓	✓	✓	✓
Organisms and their environments				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Science Content Standard D: Earth & Space Science															
Properties of earth materials				✓	✓	✓						✓	✓	✓	✓
Objects in the sky		✓	✓												
Changes in earth and sky	✓	✓	✓				✓								
Science Content Standard E: Science & Technology															
Understanding about science & technology								✓	✓						
Geography Standards															
Standard 1 – How to use maps and other geographic representations, tools and technologies to acquire, process, and report information from a spatial perspective								✓							
Standard 4 – The physical and human characteristics of places		✓													
Standard 7 – The physical processes that shape the patterns of Earth's surface								✓							
Standard 14 – How human actions modify the physical environment			✓												
Mathematics Standard 1: Numbers and Operations															
Understand numbers, ways of representing numbers, relationships among numbers, and number systems					✓		✓				✓				
Use computational tools and strategies fluently and estimate properly									✓						
Mathematics Standard 2: Patterns, Functions, and Algebra															
Understand various types of patterns and functional relationships				✓			✓								
Use mathematical models and analyze change in both real and abstract contexts					✓		✓								
Mathematics Standard 4: Measurement															
Understand attributes, units, and systems of measurement				✓			✓		✓						
Apply a variety of techniques, tools, and formulas for determining measurements	✓						✓		✓	✓					



An Overview of Elementary GLOBE Materials

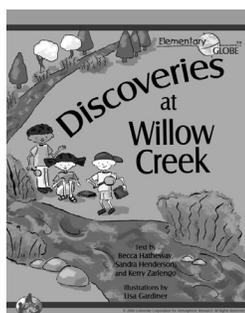


Book: *The Mystery of the Missing Hummingbirds*. The GLOBE Kids wonder why the ruby-throated hummingbirds have stopped visiting the school garden. The Kids conduct an investigation, learning more about the needs of the ruby-throated hummingbirds and the seasonal changes where they live. During their investigation, they learn about the natural environment in Costa Rica, where the hummingbirds spend the winter.

Activity 1: *All Year Long*. Students will be able to describe the seasonal changes in a local habitat by making detailed observations, recording their results, making comparisons, and sharing information with others.

Activity 2: *The Colors of the Seasons*. Students will be able to explain how colors in nature relate to their local environment and to seasonal changes within that environment.

Activity 3: *Honing in on Hummingbirds*. Students will be able to conduct a research project related to ruby-throated hummingbirds and will be able to communicate their results using different formats.

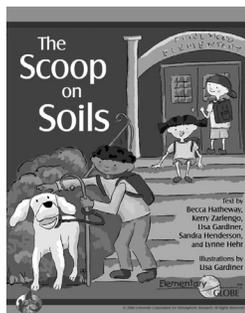


Book: *Discoveries at Willow Creek*. On their second visit to Willow Creek, the GLOBE Kids discover why the creek looks different from their previous visit. They make observations, take measurements, and look for critters in the water.

Activity 1: *Magnify That*. Students will be able to identify a magnifying lens and explain its purpose. They will be able to explain why an object looks different.

Activity 2: *Measure Up*. Students will be able to make nonstandard and standard linear measurements.

Activity 3: *Water Wonders*. Students will be able to describe adaptive features of aquatic macroinvertebrates and their importance in the scientific study of water bodies.

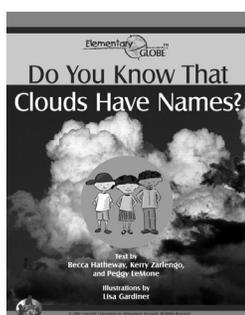


Book: *The Scoop on Soils*. The GLOBE Kids are on the trail of Scoop, an eager dog who loves to dig holes in the soil. At each hole Scoop has dug, the Kids use their journals to record the soil color, texture, and structure.

Activity 1: *Getting to Know Soil*. Students will be able to describe a soil profile and will be able to explain the different properties of soil, including texture, color, and size.

Activity 2: *Soil Treasure Hunt*. Students will be able to list things found in soil such as rocks, roots, critters, and organic materials.

Activity 3: *We All Need Soil!* Students will be able to explain soil's function for plants and animals and the overall importance of soil science.

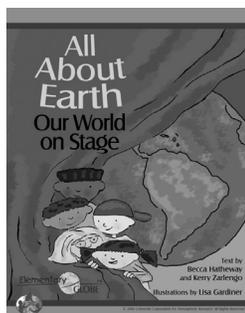


Book: *Do You Know That Clouds Have Names?* The GLOBE Kids share information about the different cloud types by acting out analogies related to cloud shapes.

Activity 1: *Cloud Fun*. Students will be able to describe the shape and appearance of cumulus clouds. They will be able to explain what kind of weather is to be expected when cumulus clouds are present.

Activity 2: *Cloudscape*. Students will be able to identify cloud types using cloud classification names.

Activity 3: *To Spread or Not to Spread*. Students will be able to identify the three types of contrails.



Book: *All About Earth: Our World on Stage*. The GLOBE Kids are excited to perform a play demonstrating what they have learned about the Earth and its parts. A problem comes up when the Kids start to argue about which component of the Earth system is most important and should have the lead role in the play. As the Kids work through the components, they come to understand the importance and interconnectedness of the sun, water, air, soil, and living things.

Activity 1: *Earth System in a Bottle*. Students will be able to conduct an experiment designed to test a plant's need for water, sunlight, and soil.

Activity 2: *We're All Connected*. Students will be able to explain how the Earth's processes and components are interconnected.

Activity 3: *Earth System Play*. Students will be able to demonstrate their knowledge of how water, air, soil, and living things interact in the Earth system.



Additional Resources

The following resources will help teachers implement Elementary GLOBE in K-4 classrooms. These resources have been referenced in this implementation guide or in the Elementary GLOBE storybooks or learning activities.

General

Books

- *What's the Matter in Mr. Whisker's Room?* - Michael Elsohn Ross

Web sites

- Digital Library for Earth System Education (DLESE) - www.dlese.org/library/index.jsp
- The GLOBE Program - www.globe.gov
- The National Science Digital Library (NSDL) - nsdl.org
- United Nations Environmental Programme (UNEP) Story Time - <http://www.unep.org/tunza/children/Story-Time/index.asp>

Science Inquiry and Literacy

Books

- *Constructing Science in Elementary Classrooms* - Norman G. Lederman, Judith S. Lederman, and Randy L. Bell
- *Inquiry and the National Science Education Standards* - National Research Council
- *Linking Science & Literacy in the K-8 Classroom* - Edited by Rowena Douglas, Michael P. Klentschy, and Karen Worth
- *National Science Education Standards* - National Research Council
- *Picture-perfect Science Lessons: Using Children's Books to Guide Inquiry* - Karen Rohrich Ansberry and Emily Morgan
- *Science Notebooks: Writing About inquiry* - Brian Campbell and Lori Fulton
- *Teaching Reading in Science* - Mary Lee Barton and Deborah L. Jordan
- *The Science in Elementary and Middle School Classrooms: A Project-Based Approach* - Joseph S. Krajcik, Charlene M. Czerniak, and Carl F. Berger
- *The New Science Literacy: Using Language Skills to Help Students Learn Science* - Marlene Thier
- *The Read-Aloud Handbook* - Jim Trelease

Web sites

- International Reading Association - www.reading.org

Seasons Module

Books

- *Keeping a Nature Journal: Discovering a Whole New Way of Seeing the World Around You* - Clare Walker Leslie and Charles E. Roth

Web sites

- Journey North: A Global Study of Wildlife Migration and Seasonal Change - www.learner.org/jnorth
- Operation RubyThroat: The Hummingbird Project - www.rubythroat.org

Water Module

Books

- *How to Teach Measurements in Elementary School Science* - Neal J. Holmes and Joseph J. Snoble
- *Measuring Penny* - Loreen Leedy
- *Project WILD Aquatic: K-12 Curriculum & Activity Guide* - Project WILD
- *Wow! The Wonders of Wetlands* - Alan S. Kesselheim and Britt Eckhardt Slattery



Web sites

- Aquatic Macroinvertebrate Identification Key - www.people.virginia.edu/%7Eesos-iwla/Stream-Study/Key/MacroKeyIntro.HTML
- Benthic Macroinvertebrates in Our Waters - www.epa.gov/bioindicators/html/benthosclean.html
- Carolina Biological Supply - www.carolina.com
- Field Collection of Living Animals - www.carolina.com/tips/95jan/fcolo.asp
- Key to Aquatic Macroinvertebrates - www.dec.state.ny.us/website/dow/stream/
- River Tank Ecosystem - www.rivertank.com
- The *I Spy* Series - www.scholastic.com/ispy/

Soil Module

Books

- *Dig in!: Hands-on soil investigations* - National Science Teachers Association
- *Soil Science Simplified* - Helmut Kohnke and D. P. Franzmeier
- *Wow! The Wonders of Wetlands* - Alan S. Kesselheim and Britt Eckhardt Slattery

Web sites

- Painting With Soil - soils.usda.gov/education/resources/k_12/lessons/painting/
- Soil Crayons - soils.usda.gov/education/resources/k_12/lessons/crayons/
- Soil Science Education Home Page - soils.gsfc.nasa.gov/

Cloud Module

Books

- *International Cloud Atlas* - World Meteorological Organization
- *Predictable Charts: Shared Writing for Kindergarten and First Grade* - Dorothy Hall
- *The Book of Clouds* - John A. Day

Web sites

- Contrail Education - asd-www.larc.nasa.gov/GLOBE/

Earth Module

Books

- *Bottle Biology* - Mrill Ingram
- *The Carrot Seed* - Ruth Krauss
- *This is the Sunflower* - Lola M. Schaefer

Web sites

- Bottle Biology - www.bottlebiology.org
- Wisconsin Fast Plants Program - www.fastplants.org



Inquiry Skills Checklist

The following is a list of prerequisite skills that elementary students need in order to make sense of scientific processes. After gaining experience with these skills, students will be prepared to put them to use (with teacher guidance or by themselves). Use this vocabulary with your students, and as they become more immersed in the vocabulary and scientific process activities, point out how they are thinking and acting like scientists in their everyday lives.

After completing an Elementary GLOBE learning activity, check off the different skills your students used in the activity. You can also write additional notes about how this learning activity can help your students gain experience with scientific processes.

Learning Activity Title: _____

What did you do in this activity?

- | | | |
|--------------------------|----------------------|---|
| <input type="checkbox"/> | Observing | Looking/watching things with a purpose |
| <input type="checkbox"/> | Questioning | Formulating questions based on observations |
| <input type="checkbox"/> | Sequencing | Putting something in a certain order |
| <input type="checkbox"/> | Patterning | Forming and following a set pattern |
| <input type="checkbox"/> | Counting | Understanding quantity, one-to-one correspondence |
| <input type="checkbox"/> | Measuring | Using standard and nonstandard units |
| <input type="checkbox"/> | Comparing | Noting differences and similarities of things |
| <input type="checkbox"/> | Classifying | Putting things into definite categories |
| <input type="checkbox"/> | Defining | Developing and enhancing vocabulary |
| <input type="checkbox"/> | Communicating | Describing and sharing information with others |
| <input type="checkbox"/> | Hypothesizing | Making an informed guess |
| <input type="checkbox"/> | Predicting | Thinking ahead about what might happen |
| <input type="checkbox"/> | Inferring | Using reasoning to draw conclusions |
| <input type="checkbox"/> | Recording | Writing or drawing gathered information |
| <input type="checkbox"/> | Reporting | Using information and communicating it to others |

Notes: _____

Adapted from *Young Children*, September 1999